

INFECTIOUS DISEASE

Diagnosing COVID-19

Medical workers struggle to find the best way to test for coronavirus infections

China continues to fight the outbreak of a novel coronavirus, called severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), which has infected tens of thousands and killed more than 2,100 people since the end of 2019. The outbreak's hot spot is in the central province of Hubei, in particular, its capital city Wuhan, where there have been more than 62,000 infections and 2,029 deaths as of last week, according to the World Health Organization (WHO). There, doctors and scientists are desperately struggling to find reliable ways to diagnose infected patients to help treat them and control the spread of the virus. The struggle has involved two diagnostic options—computed tomography (CT) scans of patients' lungs and a nucleic acid lab test—each with advantages and disadvantages.

With “a suddenly rampant new virus, it is normal to have multiple test approaches,” says a virologist at the Chinese Center for Disease Control and Prevention (China CDC) who asked not to be named because they were not authorized to speak to the media. “The key is not which one is the best but how they can support each other.”

The lab test analyzes nucleic acids extracted from patient saliva or mucus

samples and compares them against sequences in the genomes of known coronavirus strains. The CT screening method highlights indications of the disease, such as signs that fluid has filled the lungs, but can't specifically link those indications to the virus. Also, as a recent report notes, not all infected people have abnormal CT lung scans (*Radiology* 2020, DOI: 10.1148/radiol.2020200230).

Differences in data between these two methods caused a stir 2 weeks ago. On Feb. 12, China released data showing 15,000 newly confirmed cases of infections, mostly in Hubei, more than five times the number of cases in the previous day's report. The magazine *Caixin* reported that this jump was due to Chinese officials revising the diagnostic criteria for confirming infections. The new criteria allowed doctors in Hubei to use clinical CT screening alone to confirm infections instead of waiting for confirmation from the lab test.

The Chinese government quarantined the entire of city of Wuhan on Jan. 23. Facing increasing numbers of patients and dwindling availability of hospital beds, the local government decided to hospitalize only those patients with confirmed infec-

tions. Fever and a CT scan showing signs of deteriorating lung conditions were considered criteria to suspect a patient had an infection, but confirmation required two positive nucleic acid kit tests.

The lab test requirement soon led to problems. Demand for the testing kits skyrocketed and led to shortages. Media and social media posts reported dozens of suspected deaths from coronavirus disease 2019 (COVID-19), the disease caused by SARS-CoV-2, in cases in which patients' infections could not be confirmed because of a lack of kits to run the necessary tests. In at least one confirmed case, a family of four died before most family members could be admitted to the hospital.

“The early undersupply of nucleic acid kits can be overcome relatively easily, but it is hard to solve the bottleneck of testing capacity,” the China CDC virologist says.

The test also requires highly specialized expertise that doctors and nurses have not been trained for. In addition, it relies on polymerase chain reaction technology to amplify nucleic acids in a sample, and that process can take up to 6 h, meaning labs struggle to deal with thousands of tests each day. Shortages and long testing times are just part of the problem. Wang Chen, a pulmonologist at Peking Union Medical College, told China's central television on Feb. 5 that the nucleic acid test's accuracy is less than 50%. The China CDC virologist explains that coronavirus is often concentrated in the lower part of the respiratory system, meaning viral loads in a saliva or mucus sample may not be concentrated enough to be detected by the test.

Despite the nucleic acid test's downsides, scientists note that it is still the most definitive way to identify an infected patient. But including CT scans as a diagnostic tool not only helps get patients treated faster but also controls the spread of the virus.

Quickly hospitalizing people with COVID-19 has become a priority for controlling the outbreak to prevent infected people from passing the virus to others. The strategy of relying on CT screening alone to admit patients is a compromise, says the China CDC virologist, who points out that those who have been hospitalized with CT screening alone also get tested using other lab methods when conditions allow it.—HEPENG JIA, special to C&EN

Patients infected with SARS-CoV-2 sit in a temporary hospital in Wuhan, China.



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